

machine allows the application of a real cement mortar under pressure, and in such way that the pores in the surface of the steel are entirely filled with the fine cement particles; and the entrained air which always accompanies hand-placed mortar concrete, is removed, so that the highest degree of efficiency in this connection is obtained. It is always necessary to clean thoroughly the surface of the steel before any application, and this machine combines the qualities of a sand-blast machine with its capacity to place this mortar.

It will be noted from the various photographs the numerous places at which this process has been used. At Grand Central Station, New York City, over one million square feet of steel surface has been covered at a cost less than the usual cost of forms for pouring concrete and at an enormous saving of the dead load. The same thing can be said of the bridge over the B. & O. tracks at Calvert Street, Baltimore; three viaducts over the railroad tracks at Columbus, Ohio; the ferry bridge of the Pennsylvania Railway at Cortland Street, New York City; the girders over the tracks at the West Philadelphia Station of the Pennsylvania Railway; etc.

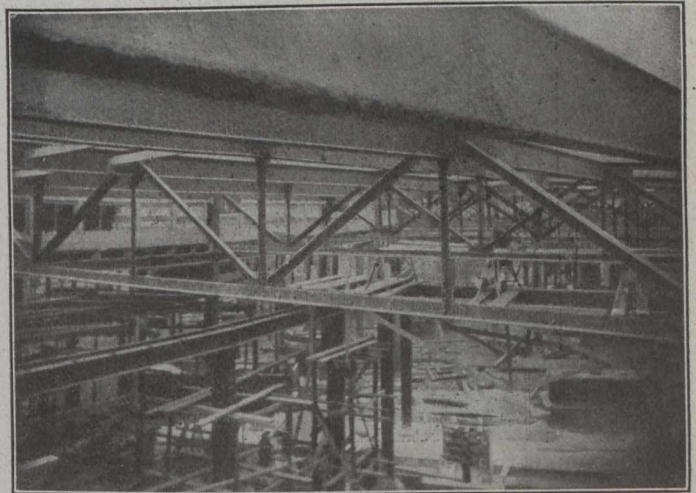
There is a considerable diversity of opinion among engineers as to whether it is necessary to provide a reinforcing mesh in connection with this work. At Grand Central and other places they have believed such a mesh necessary to obviate the possibility of vibration causing a break-down prior to set, but on the other hand the Pennsylvania Railway engineers do not use the mesh. Prior to doing the work at Cortland Street very exhaustive tests were made regarding dampness, freezing and thawing, with the result that reinforcement was deemed to be a needless expense. The engineers of the Pittsburgh & Lake Erie Railway also took the same risk in the protection of the steel in the new freight house at Pittsburgh.

An unusual adaptation of this work was the case of a bridge near Worcester, Mass., some girders of which were covered with this mortar and afterwards transported a distance of several miles before being placed in position.

One of the most interesting uses of this method of placing mortar is that of protecting the exposed surfaces of cuts and tunnels against the action of the atmosphere. It has been found that on account of the imperviousness of the material, the gases and moistures have been excluded from the surface, thereby preventing the breaking down so commonly present. Accompanying photographs of the work done on the surface of the rock-cut along the

New York Central Railway at Spuyten Duyvil, and on the tunnel of the Illinois Central Railway at Unionville, Indiana, are illustrative of this.

One of the most important adaptations of this principle, however, is in the work being done in the preservation of the roofs and sides of mine entries and rooms against such deleterious agents. The writer has had the experience recently of having examined a number of coal mines where the losses due to this slacking have been very serious, both in life and property. Especially in the summer months, the stream of warm air from the outside meeting the cooler air of the mine, causes great condensation to take place on the roof, with the result that the



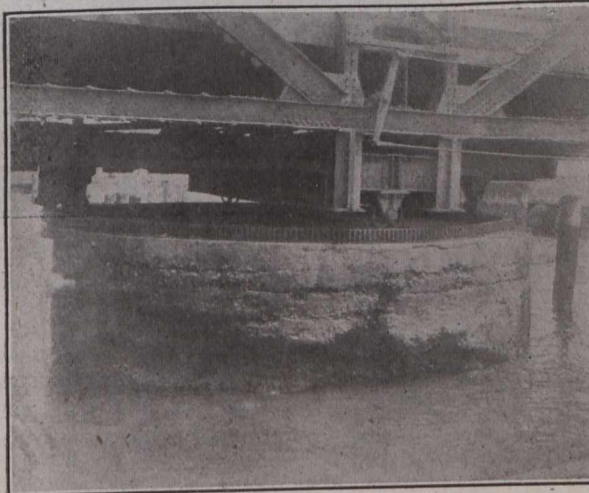
Gunite Over Mesh—Worcester Bridge.

moisture and gases act very rapidly on the superimposed stone, shale or slate, causing rapid disintegration and consequent dropping. It has been found that by applying a coat of this impervious mortar to a thickness of about one-half inch, the moisture is excluded and this breaking-down action prevented.

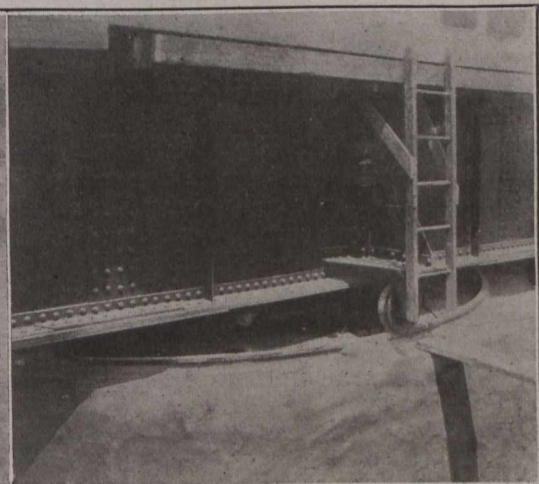
It is the confident assertion of a number of the most prominent coal engineers that this will mean the saving of hundreds of thousands of dollars worth of steel and timber, besides enabling the operators to reduce the size of their entries.

Another interesting development of this method of placing mortar is the lining of irrigation ditches and

MACHINE-PLACED MORTAR REPAIRS TO ATLANTIC CITY RAILWAY BRIDGE PIER.



Condition of Pier Before Applying Mortar.



Pier, Repaired, Stays in Service.